

THREE DIMENSIONAL PATTERN IN TEMPERATURE TRENDS: SIGNATURE FOR OZONE DEPLETION OR GREEN HOUSE GASES?

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A recent article by Santer et. al. (Nature, 1996) presented a comparative study between model and observations of vertical and horizontal temperature trends. The model simulations included anthropogenic changes in; green house gases (GHG), aerosols, and stratospheric ozone for the period 1963 to 1987. The model predicted that lower troposphere in the southern hemisphere would warm faster than more polluted northern hemisphere due to the aerosol "whitehouse" effect. More importantly, the data and model agree in the vertical profile of temperature trends, both showing slight warming in the lower troposphere but substantial cooling in the lower stratosphere. This study has since been described as the long awaited smoking gun that links human activity to climate change.

We present an analysis of a data set that covers the period of 1957 to 1996. Our study is designed to take advantage of this longer climate record to examine how robust the conclusions reached by Santer et. al. are when the examined time period is changed. In particular, we find the hemispheric differences in temperature trends, which is one of the corner stones of the Santer et. al. study, to be highly dependent on the exact time period one chooses to examine.

In contrast with the analysis of the short temperature record by Santer et. al., temperature trends in the southern hemisphere show *no* change over the 39 year period. Trends in stratospheric temperatures show distinctly two different periods; from 1957 to 1980 when the temperature remained virtually constant, while from 1980 to present stratospheric temperatures plunged at a rate of 1.2 degrees per decade. Specifically, spring time southern polar temperatures have been decreasing at a rate of 3.0 degrees per decade since 1980. A comparison between trends in stratospheric temperatures and ozone reveals a tight correlation. We conclude that the major driving force behind the vertical profile of temperature trends is ozone depletion and not GHG.